Faculty Working Papers

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Norton M. Bedford, Professor of Accountancy

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College of Commerce and Business Administration
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Abstract:

The Theory of Rational Expectation assumes all information relevant to an economic decision is compounded into the market. The information set is assumed to be comprehensive, extending well beyond traditional accounting information. Holding that price is set by the interaction of all public information available in any point in time, the Rational Expectation Hypothesis questions traditional accounting time series analyses that predict future prices by extrapolating from past accounting data. The implications of the Rational Expectation Hypothesis (REH) to accounting are as follows: (1) An expanded income statement should be provided. (2) Accounting information systems should cover larger data base systems. (3) The cost and value of alternative accounting information should be provided. (4) The general price level adjustment should be made. (5) Accounting information should assume that governmental policies cannot control the economy as precisely as desired. (6) Detailed information on risk alternatives should be disclosed. (7) Research is needed to determine the circumstances under which a larger information set will be relevant for forming rational expectations.

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[illegible]

[illegible] information [illegible]

[illegible] concept [illegible]

[illegible]

THE THEORY OF RATIONAL EXPECTATIONS AND ITS APPLICATIONS IN ACCOUNTING

by

Norton M. Bedford
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Prefatory Note

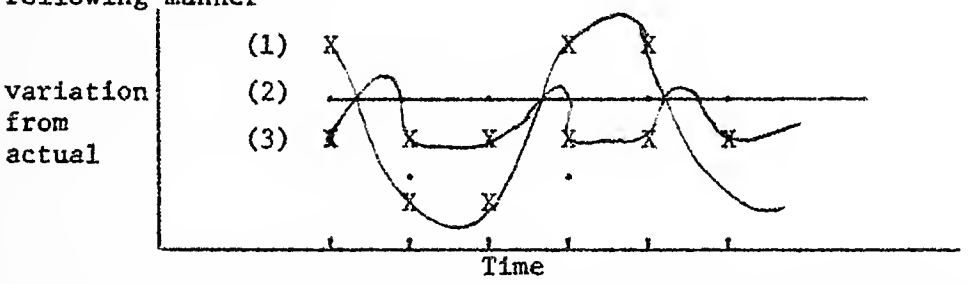
If asked "What income do you expect the XYZ Company will report next year?" and having absolutely no information, your answer would have to be a guess--a random guess. In such a state where no information is made available to you, you could and probably should form your expectations of next year's income from a table of random numbers--all negative and positive numbers.

An analysis of your randomly formed expectations over several years would reveal that they approach "zero" as an averagae, but that annual variations from the "zero" average or from actual results would be very large. This very high variation would suggest that you do not have a good method for forming expectations of future income. Presumably, you would want to develop a method that would improve your expectations of future events.

Accountants implicitly believe expectations of future income can be improved by information on past income. So let me tell you each year on January 1 the income of the XYZ Company for the past year and then ask you "What income do you expect the XYZ Company to have next year?" Will your answer be a random guess? Probably not, because you would think that next year's income will be somewhere within a reasonable range of last year's income. Assume you always estimate next year's income to be exactly the

same as last year's income. Your expectations over the years will differ, of course, from actual results. But the significant feature is that your annual expectations of next year's income, using only information on the immediate past year's income, vary from actual results much less than they did when you used the random numbers method for forming expectation. The use of information on last year's income as a method for forming expectations of next year's income results in a reduction in the extent of the variations of actual incomes from expected incomes. The mean (average) of the squared deviations of actual from expected income is considerably less than a similar measure when expectations were random estimates.

The results of both methods for "forming expectations" of next year's income, expressed in terms of variation from actual may be viewed in the following manner



where (1) reflects the variations from actual when the random number method of forming expectation is used and (2) reflects the variations from actual when last year's income method of forming expectation is used. The smaller variations of the latter indicate it is the better method.

But formations of expectations on the basis of last years results are not sufficiently accurate to avoid many undesirable economic consequences, so let us assume you employ an accountant to measure each year's income very accurately and to keep a record of the annual income for several years. You

now know not only last year's income but you also know annual inocme is not the same each year. To help you form a more rational expectation of next year's income, assume your accountant makes a study of the trend of annual incomes over several years. As part of his time series analysis he determines the extent that actual annual income varies over time. Then he extrapolates the trend of annual incomes and calls to your attention that while variations from actual still exist, the expected income for next year is not identical to last year's income. The use of the time series analysis method for forming an expectation of next year's income results in more accurate expectations than either the random number method or last year's income method. Variations from actual are smaller.

Now assume the accountant examined the relationships among past years' incomes and found that better expectations of next year's income could be formed if a weight of three was given to last year's income, a weight of two to income of two years past, a weight of one to income of three, four, and five years, and a weight of "zero" to all income measures over five years old. The use of the resulting weighted average provides an estimate of next year's income from which actual results vary less than any other time series method for forming an expectation of future income. The implication is that improved information can improve the expectation formation process.

Methods used for developing information to form expectations or predictions of future prices, income, or any variable are of two broad types.

1. The <u>direct</u> expectation formation process, where an extrapolation of the pat history of the variable being predicted is studied and an estimate of that "output" or result variable is made

directly by extrapolation of a time series of data.

2. The indirect expectation formation process, where the estimation of the variable being predicted is made by examining the "input" or factors causing the output to be whatever it is. The use of this method requires information well beyond the past history of the variable being predicted.

Studies show that the indirect method, where all information bearing on the factors causing the output is used, is the best method for forming an expectation of a future event. It is the method supported by rational expectation theory.

The Theory

The hypothesis of rational expectations (REH) is well established in economic theory.[1] Originally proposed by John Muth in 1961, REH holds that decision makers are rational economic actors and will predict (or form an expectation of) future variables (prices, income, supply, demand), by using in an efficient manner all available information on the facts of the past. Stated in terms analogous to the efficient market hypothesis (EMH), which evolved later (Eugene F. Fama, January, 1965, Journal of Business) as a parallel and largely redundant concept in the

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[1] Expectations are defined as informed predictions of future events and there are two expectations hypotheses. The first, known merely as the "expectations hypothesis" merely states that economic agents force into equality present prices with those expected to prevail in the future. The second hypothesis is that economic agents are rational and that expectations or predictions of all types incorporate in the decision process all available information in an efficient manner. Neither hypothesis meets the requirement that expectations or predictions be very accurate.

finance area, REH asserts that decision makers collectively impound into the expectation formation process all public information relevant to the decision. This includes all accounting and non-accounting information on the operations and activities of an economic entity and all accounting and non-accounting relevant information on the structure and operations of the economy. Expectations or predictions of prices or any economic variable are in this sense "right" or "correct" because they are the result of the rational efficient use of all known information at the time the expectation is formed.

The empirical evidence in support of the rational expectation hypothesis is that in the aggregate the average of business expectations of future variables (prices, demand, etc.) tend to agree with the average of the actual amounts of the variables (prices, demand, etc.). Businessmen expectations "on the average and in the aggregate" are neither too high nor too low. Collectively, they are neither inborn pessimists nor inborn optimists. They are rational and analytical in forecasting the future.

The rational expectation hypothesis does not assert that the expectations or predictions of individual businessmen are precisely right for short-periods of time. To the contrary, random variations due to unexpected developments are expected in each short-period of time, but over the longer-term and in the aggregate as many favorable unexpected developments occur as do unfavorable unexpected developments so that "on the average" expectations are as good as actuals.

The hope of every predictor or economic planner is, of course, that the expectation formation process can be improved so that many of the

unexpected developments can be expected with the result that variations from actual results will be smaller than they otherwise would. Rational expectation theory does not dispute that hope, but it does suggest that the information set now used by business and economic planners in setting expectations is much more comprehensive than that formally recorded in any conventional accounting system. Additionally, rational expectation theory holds that decision makers use all the information in a sufficiently efficient way to avoid being consistently wrong when compared with actual results. "On the average", the expectations formed are as good as the actual events. This means that those hoping to improve the prediction or expectation formation process may have a more difficult task than may be initially assumed. Hopefully individual expectations can be improved by better information so that the variations of actual from expectations are reduced.

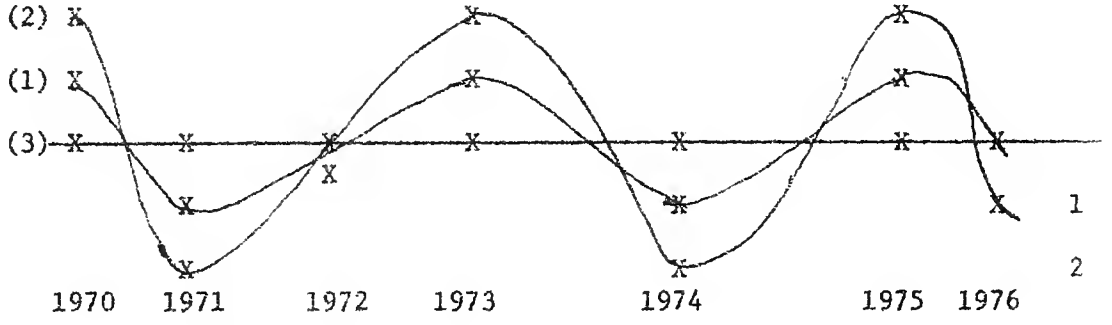
By way of further clarification, rational expectation theory does not provide a means for identifying the relative importance of the information provided by the accounting information system or any other information system. Because the process by which expectations are formed is still to some degree a "black box", it is not possible to determine in any precise and objective manner the importance of any information system though, as we shall see later, it does suggest research on it. Rather REH asserts that <u>all</u> available information is impounded into the expectation formation process, whatever the scope of "all information" might be. Given that condition accountants, not knowing the role of accounting information in the expectation process, can only endeavor to improve the preciseness

and objectivity of their measures or expand the accounting information system. The accounting information system could be expanded to include a means of providing additional information--replacing some other information system or adding new information for processing in forming expectations or making predictions.

The formation of expectations or predictions of the future amount of an economic variable under rational expectation theory should be contrasted with the process of forming predictions by extrapolations, using time series analysis such as Box-Jenkins techniques and other less sophisticated extrapolations, of one variable from its past history. Under REH rational action is more than merely the unbiased or most realistic extrapolation of the past history of the variable being predicted or about which an expectation is formed. For example, the rational expectation hypothesis would assert that expected earnings of a business entity could not rationally be predicted by a times series analysis and extrapolation of past earnings alone, no matter how objective the process might be. REH would insist that information on the past history of all inputs associated with the entire structure of the relevant system in which the earnings are earned would be used in developing an expectation about future earnings. This amounts to an assertion that rational economic actors or decision makers use an information set larger than, though including, the past history of the variable being expected. Essentially, the portion of this larger information set not included in time series analysis is information on the entire system in which the variable exists.

The following charts indicate the necessary relationship that must exist between expectations formed according to rational expectation theory and the predictions of any time series analysis.

A. Case I, where both time series analysis and the rational expectation hypothesis provide expectations equal to actual events "on the average", is shown below.



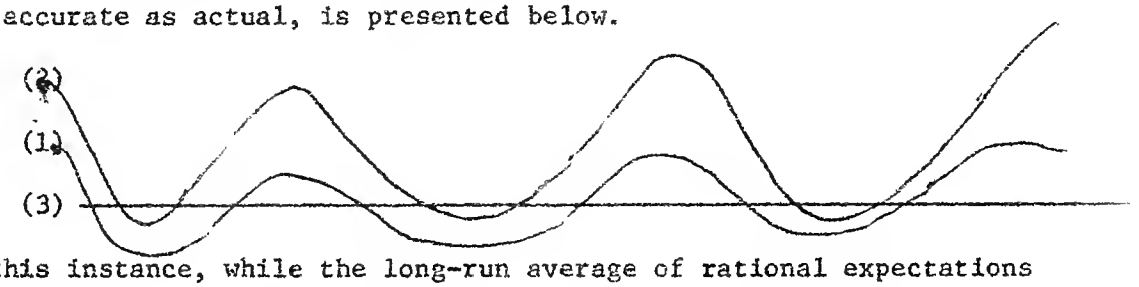
(1) Rational expectations over time

(2) Time series predictions over time

(3) Actual results over time

The variance of the time series analysis (σ_τ^2) is greater than the variance of rational expectations (σ_r^2) indicating the greater preciseness of rational expectations.

B. Case II, where time series analysis "on the average" is not as accurate as actual, is presented below.



In this instance, while the long-run average of rational expectations ($\bar{M}r$) is equal to the long-run average of actual results ($\bar{M}a$), the average of the time series analysis ($\bar{M}\tau$) is higher and has greater variance than the rational expectations.

In this instance[2]

$$\bar{M}r = \bar{M}a < \bar{M}t \quad \text{and}$$

$$\sigma_t^2 > \sigma_r^2 > \sigma_a^2 = 0$$

Accounting Application One

The rational expectation hypothesis has been used in many important areas: econometric models, government economic monetary and fiscal policy, and speculative markets. Spanning all of these as one overall general application or implication of REH to accounting is support for an expansion of the scope of the accounting information systems. Associated with this implication is the theoretical support REH provides for the detailed (expanded) disclosure in the income statement of the expenses and revenues associated with the income measurement rather than the single figure disclosure of the amount of the periodic income. REH indicates that the detailed information is used in predicting or forming an expectation of future income. Extrapolation of past single figure income measures alone using time series analysis is not, according to the rational expectations hypothesis, the way predictions or

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[2]It should not be assumed from the above that actual results will be identical each period of time, which the straight line for actual results may suggest. In fact, actual results will fluctuate over time but however actual results fluctuate, the significant information is the variation of rational expectations and time series predictions from actual results. Further, the relative predictive efficiency of both extrapolative predictors and comprehensive predictors that use knowledge of the entire economic structure in which the variable of concern performs will depend upon the statistical qualities of the processes generating the inputs to the expectation formation process.

expectations are formed. The detailed information on past revenues and expenses and other external supplemental information on the economic system is also used in the expectations formation process. While there is no well documented study to indicate the precise way expectations or predictions are formed, several accountants have long insisted that the set of information provided by the accounting process should be expanded to be relevant. But they have not been able to support their assertion with anything other than anecdotal evidence and limited empirical research data. They have had no conceptual rationale for their beliefs. Rational expectation theory provides the needed theoretical basis for their point of view. It implies that to be most relevant for rational decision making or rational accountability reporting, the accounting information system should be expanded to include all information on the relevant aspects of the economic structure in which the entity operates, and that this information be appropriately disclosed in accounting statements. Practically, the public expectation of the usefulness of accounting information will gradually require the expansion of the accounting system until it provides the information called for by rational expectation theory. This will require disclosure of the following types:[3]

(1) Activities of the enterprise.
(2) Activities of competitors.
(3) Developments in the industry.
(4) Activities of government.
(5) General economic conditions.

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[3]Professors W. W. Cooper and Y. Ijiri have proposed an expanded income statement for social accounting reporting purposes. The same format could be used to provide disclosure of information on the entire system in which an entity operates. See Bedford, N. M. ed. Accountancy in the 1980s - Some Issues, Council of Arthur Young Professors, Reston, Va., 1977, pp. 105-157.

The one clear overall implication of rational expectation theory to accounting in that only by broadening the scope of accounting disclosures will the accounting information system be able to provide more of the information useful for forming rational expectations needed for accountability evaluations and decision making. The expansion is appropriate because REH asserts that expectations will differ if information on either the activities of the business entity, now covered in part by the accounting information system, or the structure of the socio-economic systems changes--the latter now being beyond the scope of the accounting information system.

It might be contended that the scope of the accounting information system need not be expanded because decision makers have developed other information systems and use them to supplement accounting information system until collectively decision makers now have a total information system that enables them to form rational expectations of the future. The contention might even be expanded to assert that expansion of the accounting information system would be disruptive since one or more of the other information systems would have to give way because of the broader accounting information system. This may be so and if it is true that managers and other decision makers do have an economical efficient adequate set of information systems to provide all information needed for forming reliable rational expectations, there is then the need for another information set--an evaluation information set--to hold all decision makers accountable to the requirement of making effective use of all the information available, for REH now holds

only in the aggregate. If that questionable but possible proposition is accepted, rational expectation theory implies that accountants should place more emphasis on the accountability function of accounting than on the function of developing information for predicting or forming expectations about the future. In this sense, the rational expectation hypothesis could serve as the theory underlying the increasing emphasis now being placed on the accountability function of accounting information.

Econometric Models

We turn now to the specific areas where rational expectation theory has been used: (1) managerial internal planning and control (econometric models), (2) public economic monetary and fiscal policy (macro-economic planning), and (3) investor-creditor decision making (speculative markets).

In the area of econometric models REH has been used to examine the circumstances under which an information set larger than the past history of the variable of concern will be required for the development of rational expectations.[4] This type of examination is appropriate because more than one input variable normally influences the output variable and information on the multiple input variables is needed. The conclusion of the examination is that the expected value of a rational expectation of a future price will have a lower mean--square prediction--

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[4]Studies of expectations have shown that averages of expectations in an industry, where all available information apparently would be impounded into the expectation formation process, are more accurate than naive prediction models. (See Heady, E. O. and Kaldor, D. R., Journal of Political Economics, Feb., 1954. pp. 34-47.) One study indicates the REH Model predicted better than the best Box-Jenkins extrapolative models. Use C. R. Nelson, "The prediction performance of the FRB-MIT-Penn Model of the U.S. Economy." (American Economic Review, December, 1972.)

error and will yield a higher expected utility than any time-series extrapolative derived predictor, because the former will utilize information on more input variables. This may be illustrated using first Muth's original special case, where rational expectations and extrapolatives are identical and then a more general version developed by Nelson where the two do not coincide.

A. The common prediction model (rational expectations = extrapolative predictors) - which assumes that random variations are normally distributed, that certainty equivalents exist for the predicted variables, and that the functional relationships are linear--for short run price fluctuations in an independent market of non-inventoriable products that take one time period to produce, is as follows:

Let D_t = effective demand (number of units consumed) for a product in time period t

p_t = price of the product in period t

p_t^e = market price expected to prevail during period t on the basis of information available through time period t-1

S_t = supply (number of units produced) of the product in time period t

Let D_t = function of price $[f(p_t)] = \beta p_t$

If the production period is one time period;

S_t = function of expected price $[f(p_t^e)] = \gamma(p_t^e) + x_t$

where x_t = random variations in the number of units produced in time period t (supply).

Assume equilibrium price is established so that the market matches demand and supply and since no inventory is held, then

$D_t = S_t$ or

(1) $\beta p_t = \gamma(p_t^e) + x_t$

Given that the market is to be cleared each period of time and given the rational expectation hypothesis that <u>in the aggregate</u> expectations of the value of a variable are as accurate as the actual value of the variable ($P_t = P_t^e$), then we can let β and γ modify an expected price variance p_t^e so that if the rational expectation hypothesis is valid then the following model of expectations is generally valid.

(2) $\beta(p_t^e) = \gamma(p_t^e) + x_t^e$

where x_t^e is the mathematical expectation of x_t derived from information available through t-1. It is also the expected value of the difference between demand $[\beta(P_t^e)]$ and supply $[\gamma(P_t^e)]$ in period t. From this it follows that if beta (β) and gamma (γ) are known, then the amount by which market price is expected to vary from equilibrium or mean price in period t is

$$P_t^e = \frac{1}{\beta - \gamma} x_t^e$$

Since x_t is the result of a number of different causes of disturbances, it has a random characteristic though the impact of past disturbances on x_t may vary with time. This permits x_t to be defined as a discrete linear stochastic process, composed of a series of random disturbances (μ_{t-i}), with weights of h_i, having a mean equal to zero, as follows

$$x_t = \mu_t + h_1\mu_{t-1} + h_2\mu_{t-2} + \ldots,$$

Consequently, the expectation is that x_t during time period t based on information available through period t-1 will be

$$x_t^e = E(x_t | \ldots, \mu_{t-2}, \mu_{t-1})$$

$$= \sum_{i=1}^{\infty} h_i \mu_{t-i} \tag{3}$$

Now we know from (2) that

$$p_t^e(\beta - \gamma) = x_t^e \quad \text{and}$$

$$p_t^e = \frac{x_t^e}{\beta - \gamma}$$

Then using (3) and substituting

$$p_t^e = \frac{\sum_{i=1}^{\infty} h_i \mu_{t-i}}{\beta - \gamma} = \sum_{i=1}^{\infty} \frac{h_i}{\beta - \gamma} \mu_{t-i} \tag{3A}$$

It is evident from (1) that p_t may be expressed as a discrete linear process, as the following sequence indicates

$$p_t = \frac{\gamma}{\beta}(p_t^e) + \frac{x_t}{\beta}$$

Note that we are dealing with the actual price variation from equilibrium (mean) price at time t. This means that the disturbance x_t can be expressed as a known random quantity variable u_t (reduced to a price impact measure by dividing by β). Further under the rationality assumption that expected price E(P) equals equilibrium price, we can drop γ/β and express P_t^e in form (3A) and arrive at

$$P_t = \frac{u_t}{\beta} + \sum_{i=1}^{\infty} \frac{h_i}{\beta - \gamma} u_{t-i}$$

Abbreviating the functions β, γ, and h_i into ϕ_i the above may be expressed in autoregressive form

$$P_t = \sum_{i=1}^{\infty} \phi_i P_{t-1} + \frac{1}{\beta} u_t$$

where ϕ_i are functions of β, γ, and h_is

Since the expected value of the random variations of normally distributed disturbances is zero, the equivalent of (3A) may be expressed

(4) $$P_t^e = \sum_{i=1}^{\infty} \phi_i P_{t-i}$$

which indicates that P_t^e depends solely on past prices. That is, in this special case where only the amount of supply is subject to a disturbance X_t, the initial model proposed yields a rational expectation of price that could be replicated by a time-series analysis using only the past history of prices without knowledge of the market structure in which prices are formed. Now we will violate the assumptions of that model and show that time-series analysis will not yield the same expected price as REH.

B. The more generalized model--which will be restricted for demonstration purposes to include as disturbances, in addition to supply disturbance X_t, only disturbances in the demand equation, though in concept the generalized model refers to all information on the structure of the relevant economy. Specifically, let us adjust the previous

model by letting

$$D_t = \beta p_t + y_t$$

where y_t = disturbance factors that influence the demand for units of product. Like x_t it can be expressed as a discrete linear process.

Then the statement that $D_t = S_t$ becomes

(1') $$\beta p_t + y_t = \gamma(p_t^e) + x_t$$

(1'a) $$\beta p_t = \gamma(p_t^e) + x_t - y_t$$

(1'b) $$p_t = \frac{\gamma}{\beta}(p_t^e) + \frac{1}{\beta}(x_t - y_t)$$

or more generally when the rational expectation hypothesis holds

(2') $$\beta p_t^e - \gamma p_t^e = x_t^e - y_t^e$$

(2'a) $$p_t^e = \frac{1}{\beta-\gamma}(x_t^e - y_t^e)$$

In this modeled situation, the rational expectation of price depends upon the mathematical expectations of both of the disturbances y_t and x_t. Assuming the y disturbance is the result of another series of independent zero mean observed variables or unobserved shocks (v's), y_t may be expressed as follows

$$y_t = v_t + g_1 v_{t-1} + g_2 v_{t-2} + \ldots,$$

then the mathematical expected value of y based on information through t-1 is

$$y_t^e = E(y_t | \ldots, v_{t-2}, v_{t-1})$$

and by assigning functional weights g_i to v_{t-i}

(3') $$y_t^e = \sum_{i=1}^{\infty} g_i y_{t-i}$$

from which, by substitution into (1'b) the equations (2'a), (3') and (3) we determine p_t to be

$$p_t = \left[\frac{1}{\beta} \mu_t + \frac{1}{\beta-\gamma} \sum_{i=1}^{\infty} h_i \mu_{t-i} \right] - \left[\frac{1}{\beta} v_t + \frac{1}{\beta-\gamma} \sum_{i=1}^{\infty} g_i v_{t-i} \right]$$

This indicates that p is the sum of two linear equations which can be generalized by the use of superscript primes (') for the functional weights and variables into the form

$$p_t = \sum_{i=p}^{\infty} g'_i V'_{t-i} + \sum_{i=o}^{\infty} h'_i U'_{t-i}$$

The rational expectation of price then is

$$(4') \quad p_t^e = \sum_{i=1}^{\infty} g'_i v'_{t-i} + \sum_{i=1}^{\infty} h'_i \mu'_{t-i}$$

Which is the equivalent of inserting equations (3) and (3') into (2'a).

This rational expectation of price cannot be expressed in terms of past prices alone because the solution to this restricted more general model must involve the past history of either x_t or y_t, in addition to p_t. This means that p_t^e can not be derived merely by the extrapolation of the past history of p_t, as time series analysis implies.

The foregoing analysis implies that the rational expectation of price (or any other variable) will depend on the structure of the surrounding system and on the past history of all factors bearing on prices, whether they are observed directly as relevant external variables that influence price or whether they are merely observed as unexpected "disturbances." This means that forecasts based on information about the relevant variables in the structure of the surrounding socio-economic system as well as the behavior of various behavioral input variables that influence price should also be used for planning purposes or establishing expectations about the future.

From the foregoing, it seems intuitively obvious and is demonstratively clear that rational expectation will be more efficient than the "best"

extrapolative predictor because it will have a smaller mean-square error from actual results since the information set from which the rational expectation is derived includes the past history of the variable.[5]

There is intuitive appeal for the foregoing mathematical demonstration that time series analysis can never be as effective as would the rational use of all information bearing on the expectation being formed. It is intuitively clear that there are several factors, internal and external to the firm, that cause price to change or remain as it is. In effect, price is the output variable resulting from the various input factors or variables causing price to be as it is. Further, it must be assumed that there are a multiple number of these input variables and that their influence on price changes from time to time. According to rational expectation theory, the decision maker compounds into the process by the input variables as well as the output variable (price). It is intuitively evident that a mere extrapolation of the trend of the output variable (price) alone can never be as accurate as would be an expectation formed by including all information on the output variable and all the input variables as well. Time series analysis uses the former output variable information while rational expectation theory uses the latter comprehensive set of information on both input and output variables in forming expectations.[5]

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[5] It is also possible to show that rational expectations are more efficient than time-series extrapolation in maximizing expected utility for each market participant.

[6] Recent developments in time series analysis does permit the inclusion of more than one variable in forming an expectation or prediction, but it can never be expanded to encompass all input variables because different decision makers use different information sets to form equally rationally expectations at different times.

Accounting Application Number Two

One implication for accounting at the managerial planning and control (micro-economic model) level of the REH follows from the wide variations in the disturbance elements (μ_t and v_t) which normally prevail. If the disturbances are wide, more accounting information can be generated by placing greater emphasis on the accountability function with the intent of motivating decision makers to improve the information sets used in forming expectations.

While the ratinal expectation hypothesis holds only in the aggregate, the significant feature is that collectively economic actors do compound into the market price all known information publicly available. In the main, individuals can not alos expect that market price if they are not aware of the information set used by the colelctive group. To the extent individuals do not use an information set at least as good as that used by the collective group, errors will be made and the economy will not operate as efficiently as it would if individuals were provided and did use the information set of the collective group. One must conclude tht the accounting accountability endeavor should be to motivate each individual, or at least individual leadrs, to use relevant items of the same information set used by the collective economic actors.

The implications is that analyses of accountability reports should attempt to reveal various features of the structure of the system in which the individual expectation formation process takes place and to identify additional exogenous variables for inclusion in the prediction process. While the REH proposes that prices or other variables behave as though all relevant

information were embodied in the expectations or forecasts, given the structure of the economic system other information might be developed to be impounded into the expectations. For example, additional information might be induced by expanding accounting reporting from accountability for the use of funds as authorized to accountability for the efficient use of the funds and even to accountability for the effective (accomplishment) use of the funds. Merely disclosing how funds entrusted to an economic entity have been used will over time provide information on relationships that have prevailed in the past, but if performance in the past has been inefficient impounding of this information into expectations may not be the most desirable information. Disclosing the efficiency with which the funds used could have been used would provide more relevant information for impounding into expectations. Going further, if accountability accounting could be sharpened to disclose what might have been accomplished with the funds that might be available to the entity, the quality of the information impounded into the rational expectations process would enhance the quality of the prediction.

Accounting Application Number Three

The application of REH to managerial planning and control econometric models indicates that it might be applied to evaluate the payoff to rational economic actors from knowledge of various aspects of the economic structure in which the decision maker operates and to evaluate the cost and value of alternative types of accounting information. The technical features of this endeavor are formidable, but conceptually it would be possible to measure the

decrease in the mean-square deviation of actual results from expectations or predictions by including on a selectively controlled basis past history of alternative combinations of exogenous input variables. Decreases in the mean-square variation from that prevailing from time-series extrapolative predictions could ultimately be reflected in gains and losses from improved expectations, in the long-run sense. The process which REH supports involves the construction of a mathematical model of the operations of an economic entity or area of activites. This mathematical model involves a series of mathematical functions and equations which reveal the relationship between various external and internal input (or causal) variables and other variables including the output variable. The model would represent both the economic structure in which expectations are formed and the relationship among variables within the structure. By including or excluding various elements in the structure and the relationship among variables, the cost and value of information on the included or excluded elements may be determined.

Associated with this application of REH to accounting is the educational implication that accounting students should include econometrics and methods of model building as part of their study program. While econometric models have not yet been able to provide forecasts with greater accuracy than those derived by extrapolations from models based on times series analysis, such as the Box-Jenkins models, rational expectation theory indicates that

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[7] For an example of the type of econometric modeling with which the accounting student should be familiar, see Sanford Grossman, "Rational Expectations and the Econometric Modeling of Markets Subject to Uncertainty" Journal of Econometrics, 1975. pp. 255-272.

they hold great promise for the future as means of specifying and estimating parameters improve in the future. More fundamental, the models will indicate clearly to accountants the limitations inherent in the use of conventional accounting information.

Macro Economics

One of the major issues in macro economics is the conflict between the money supply school (the monetarists) and the fiscal policy school (the fiscalists) as to the main determinate of aggregate economic activity. More particularly, the issue is the relative importance of money supply vs. government fiscal policies in stabilizing or minimizing down swings during the growth and development of economic activity. The objective is to foster growth in a steady manner.

John Maynard Keynes in The General Theory emphasized the need for economic stabilization to replace booms and depressions in the economy, and memory of the Great Depression fostered among others a variety of concepts suggesting that business investment and activity demand was subject to such a number of economic disturbances in an unregulated economy that stabilization policies by government fiscal policy was appropriate. For twenty years fiscal policy refinements received the attention of economists as efforts were made to develop "fine tuning" methods to stimulate or contract aggregate economic activity, as appropriate.

The monetarists, headed by Milton Friedman, began to question the practical relevance of the Keynesian framework and reached the conclusion that the impact of the economic disturbances in an unregulated economy

would be small and transient. They concluded that fiscal policy actions would have minor and transitory effects on demand while changes in money would produce large and permanent effects on money income. According to the Friedman model, it is the unexpected component of the rate of inflation that causes disturbances in the level of employment. When the rational expectation hypothesis (REH), indicating that unexpected price changes in the aggregate are small, was incorporated into Friedman's model, support for the Keynesian view declined. In macro form, the rational expectation hypothesis holds that aggregate errors in price expectations will be short-lived and random. It also suggests that the economy cannot be stabilized by fiscal policies because business entities, operating on the basis of rational expectations, will fully discount them. The consequene is that governments cannot offset by fiscal policy economic disturbances because private industry knowing of government fiscal policy will have already allowed for the fiscal policy actions prior to the occurrence of the economic disturbances.

Accounting Application Number Four

Rational expectation theory, when applied at the macro level, indicates that inflation induced by fiscal policy will be expected by decision makers. Coupling this with widely known information on money supply, the other inflation causing factor, one must conclude that the unexpected inflation element is relatively small.

Now if inflation is anticipated by private enterprise, and rational expectation theory asserts that it is, the consequence will be that

governments cannot by inflationary and deflationary stimuli stabilize the economy by fiscal means. If inflation is not anticipated, so much uncertainty would exist among business enterprises that economic activity would be curbed.

It is at times suggested that the time lag between the time governments "stimulate" the economy by fiscal policies, and the time the private sector rationally expects it is sufficiently long so that some "stabilization" of the economy is possible. Rational expectation theory holds the contrary. It holds that accountants are faced with the proposition that inflation, whether induced by government fiscal policy or other sources, is anticipated and discounted by business enterprises in forming expectations about the future for decision making purposes. To the extent that an event is discounted by business enterprise, accounting information should both report on the event and reflect the effect of the discounting. For example, a note receivable paying 5% nominal interest when the market rate is 8% is property discounted to the actual amount exchanged. Both the 8% and the discounted amount should be reported in accounting statements. Similarly, when business enterprises rationally expect inflation, future receipts are discounted for the higher price level to be prevailing in the future. To be in accord with the rational expectations of business enterprise, accountants should recognize and separately disclose inflationary "gain or loss" in accounting measures.

The Securities and Exchange Commission and the Sandilands report have done much to confuse the accounting price level adjustment called for by rational expectation theory. Both implicitly assume that much of the

impact of inflation is selective and that disclosure of the impact of changes in the general purchasing power of money need not be disclosed. Both assume a lag between the immediate impact of fiscal policy or money supply action on specific prices and the transfer of the impact of these actions to all other prices. Rational expectation theory holds the assumption to be inaccurate because all information is impounded into all the market immediately. Decision makers also rationally expect specific market price changes other than those induced by fiscal policy or money supply generated inflation. This will result in a lack of high correlation between specific price changes induced by shifts in demand and supply of particular goods and services and the inflation induced change in the purchasing power of the monetary unit. Further, in countries with high inflation rates, such as Argentina and Brazil where the annual inflation has exceeded 100% a year, the difference in specific prices changes is miniscule compared to the common general price level change due to changes in the purchasing power of money. Given the growing empirical support for the rational expectation hypothesis, it is appropriate for accounting measurements to be based on the assumption that the impact of inflation does not impinge on different goods differently in any significant way for any long period of time. Rational expectation theory supports general price level adjustment of accounting measurements.

Accounting Application Number Five

Effectively, rational expectation theory holds that the search for certainty in our uncertain world is so strong that collectively rational

economic actors form expectations of future measures of appropriate variables by using, in an efficient manner, all information that is available from past history on all input variables that influence output. Government fiscal policy actions in the past have become a part of the available information and, on the assumption that the fiscal policy actions will be repeated in the future, that information is used by private enterprises in forming expectations about the future. But it is only part of all the information impounded into the market by the rational economic actors.

Like the stock market, the market for all goods and services requires only a "rational few" who understand the ultimate impact of new information and adjust price or some other variable accordingly. The rest of us, barring misrepresentation and inefficient markets, can make no mistake. We benefit from the insights and actions of the few who become aware of the probability of future bits of news and discount the news accordingly. Only unexpected actions or events by government or other input sources will cause changes in individual behavior because only they represent new information not been previously anticipated.

The application of rational expectation theory to macro economic theory explains the response of economic actors to the repetitive use of government fiscal policy to stimulate economic activity when unemployment is high and similar actions that attempt to manipulate the productivity level of the economy. As the public came to expect these fiscal policy actions, the rational economic actors proceeded to carry on economic activity as though the governmental actions would occur. This anticipation of government action offset the impact of the goverament action when it

did occur. Once familiar with this type of rational action, the search for information on the probability of other events rapidly developed as the rational few discounted future events. The result of this rationality in economic society is a relatively stable economic system, or one where greater stability will be difficult to provide.

To the extent rational economic actors discount future developments on the basis of current external developments and probabilities developed from the past history of events, the accounting measurement system should expand the use of the accrual concept to reflect these expectations. Various accruals should be made. Self-insurance charges might be accrued. Likewise many executory contracts provide information needed for rational economic actions because they should be compounded into expectations about future variables and it seems they should be disclosed by the accounting information system.

Speculative Markets

Speculative markets are exemplified by the stock market and before examining the application of rational expectation theory to the accounting function of providing information for speculators and investors operating in that market, certain features of its use in forming expectations at the macro- and micro-economic level will provide a background for the subsequent analysis.

At the macro level, it has been observed that the government cannot overcome by trickery the tendency for rational economic actors to discount future government actions resulting from fiscal policy. If the government attempts to apply fiscal policy at random to

prevent the development of expectations about it, the public will soon learn the government is randomly changing actions and this will increase uncertainty, which dampens economic activity more than all else. Further, neither government nor the Federal Reserve System can know the public's expectations at any point in time and will never know when a given policy action will be unexpected to the public. This means the government cannot know which policy action to take to stabilize the public market.

At the micro level, rational expectations phenomenon has been used to open up for discussion the issue of the time lag between an increase in the money supply or its equivalent and the subsequent general price rise. If the increase is unexpected, the time lag may be long but if completely expected, no time lag may occur. The unresolved feature of the issue is the length of time it takes for decision makers and business planners to adjust their expectations on future prices or other variables. While some of the unconvinced maintain that the time lags are substantial, the rationalists assert that it is very short and point to the indexing of wage contracts to inflation as evidence that time lags are getting shorter.

The significance of the issue is the degree to which business planners and decision makers are informed at the time expectations are formed because under rational expectation theory, expectations are informed predictions of future events. Essentially this amounts to the fact that a company allocates productive resources to uses on the basis of an anticipated (or expected) price, and the "rightness" of the

allocation depends upon the degree to which the decision makers are informed.

Turning now to the outside investor seeking to make a gain by speculation and investment, the rational expectation hypothesis is in accord with most of the literature on the efficient market hypothesis in the finance area.[8] That is, the rate of return (dividends plus gain on sale) is accurately reflected by the formula

$$R_{it} = \alpha_i + \beta_i R_{mt} + u_{it} \text{ where}$$

R_{it} = return on stock i in time t

α_i = standard rate of return for stock i

$\beta_i R_{mt}$ = ratio of changes in rate of return on stock i (β_i) relative to the changes in the rate of return on all stock in the market

u_{it} = unexpected variation in return on stock i in period t

Accounting Application Number Six

In terms of actual rate of return, alpha and beta give the expected rate of return relative to the total market while μ refers to the unexpected element that adjusts expected return to actual return in time t.

It should be noted that α and β are relative measures statistically derived relative to the total market. No measure of the total risk associated with stock i is provided by these two measures. Further, empirical evidence indicates that the beta measures may change. Never-

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[8] For a discussion of the efficient market hypothesis, see Eugene Fama, "Efficient Capital Markets: A Review of Theoretical and Empirical Work," Journal of Finance, May, 1970, pp. 383-417.

theless the relationship hold in the aggregate and in the long run to such an extent that it must be assumed that speculators and investors, or the "rational few", do compound into the market sufficient information to support the rational expectation hypothesis that the information set used by speculators and investors is sufficient to form expectations of the risks associated with various types of investments. This set of information on risk is not now included in any formal accounting information system but the fact that the information is in the aggregate collected by speculators argues that it could be.

This REH implication that accounting measures should include measures of the elements of the return to speculators and investors will require disclosures of the following types:

(1) The return reward for waiting, sometimes referred to as the "pure" rate of interest, which is the return reward necessary to induce individuals to postpone consumption and save a portion of their income. ____%

(2) The return necessary to cover known risks normally transferred to a third party by an insurance premium payment to an insurance company. Since no economic entity is required to insure all such risks with outside parties and since self-insurance saves the administrative costs and profits of the insurance companies, the return on any investment may include a self-insurance cost for risk not requiring an economic sacrifice in the accounting period. ____%

(3) The return necessary to cover known risk on which historical data is lacking so that no statistical objective probability can be established. Subjective probabilities must be developed using objective processes such as the Delphi technique. The subjective probabilities may be used to estimate the self-insurance element included in the return on the investment for separate disclosure. _____

(4) The return for uncertainty that can not be estimated directly and may have to remain undisclosed as an element of a "profit" element. Relative changes in the uncertainty level over time can be commented upon as a disclosure feature. _____%

(5) The financing return representing portions of the above types of risks on assets not assumed by debt financing and hence a shift to the equity element of an enterprise. (This return exists only when the return to equity holders is measured). _____%

Total return _____%

Collectively, rational expectation theory holds that the above risk elements of the return are impounded into price. The implication is that accounting should measure and disclose them.

Accounting Application Number Seven

The objective of the accounting study of rational expectation theory or hypothesis is to determine the conditions under which the present set of accounting information will prove inadequate and to "examine the circumstances under which a larger information set will be relevant for the formation of rational expectations." An associated element of such

an objective is to determine both the cost of providing the larger information set and the value to the rational economic actors specifically and society generally of information on the aspects of the socio-economic society relevant to the decision process.

In one sense the objective is to examine the rather amazing growth of the information industry with which accountants, lawyers, statisticians, and computers are associated. The growth of the information industry, particularly the statistical data collected and used by government statisticians which, with the support of legal authority, has expanded to the point where individual privacy has become an issue of concern, is in need of examination. Rational expectations theory supports the construction of analytical models and empirical investigations to determine the circumstances under which various types of information are appropriate. Incidental to that examination will be the determination or at least recommendations for the scope of the accounting information system. REH provides a theoretical basis for controlling the blind explosion of the information industry.

There is also the possibility that the growth of the information industry will contribute to the growth of efficient small business firms. This assumes an effective means of providing information to smaller decision entities. A recent international seminar conducted by the Acton Society Trust of London on the size of organizations indicated that one concentration of the industrial structure did not produce efficient production. Aggregation of industrial concentration in the United Kingdom is significantly higher than in the

United States. In the late 1960's, 50% of the British labor force employed in manufacturing worked for enterprises with more than 3000 employees as contrasted with a firm size of 1500 employees for the U.S. Similarly, Japan and Sweden use 50% of their manufacturing employees in firms with less than 200 employees whereas the United Kingdom uses only 25% in similar sized firms. The conference implied that part of low productivity efficiency is due to the use of larger sized organizations. The rational expectation hypothesis implies that expectations formed on the basis of less than all information result in less efficiency. Thus, the implication of REH is that if a comprehensive accounting information can be developed for small organizations, organization efficiency and effectiveness will increase.

Other Accounting Developments in the Area of Speculative Markets Supported by Rational Expectation Theory

A. Rational expectation theory asserts that decision makers use a somewhat comprehensive set of information systems. The proposed FASB Conceptual Framework could use REH as the theoretical rationale to justify an appropriate framework for accounting disclosures.

B. The matching concept and the use of cause and effect relationships would be supported by REH and REH could be used to support efforts to reconcile current replacement cost and historical acquisition cost valuations.

C. Rational expectation theory would support the use of current value in accounting statement on the reasoning that such information is used in forming expectations and should be disclosed.

D. Rational expectation theory would hold that the dictation of accounting measures by politics that require disclosure of information not useful for forming rational expectations will weaken the general usefulness of the accounting information system to society.

E. Rational expectation theory implies that accounting systems for governments and other non-profit entities issuing securities for speculative or investment markets could and should be developed to provide information similar to that provided by profit-oriented entities.

Summary

The implications of rational expectation theory to accounting are profound. If other information systems have been developed until economic actors do form rational expectations about the future, then the implication is that accounting disclosure should place greater emphasis on accountability reporting. Alternatively, accounting could be expanded to provide much of the total information used in the forming of rational expectations. A number of these changes have been cited in this introduction to a fundamental theoretical base for the development of accounting thought and practice. Collectively these and other changes in accounting will broaden the accounting information system until all information now impounded into the markets as suggested by REH is included in the accounting information system. This will require a significant change in the accounting education program with greater emphasis on the use of computers and the study of statistical methods appropriate for the collection and analysis of much of the

data on general economic and social developments now provided by governmental agencies. The general economic and social development data need to be subjected to audit and if they are to be objectively measured and disclosed, they need to be developed by independent accountants. There is a need to lend greater creditability to data external to the operating entity.

The essence of the rational expectation hypothesis is that the way expectations are formed, prior to deciding upon courses of social and economic actions, depends specifically on the scope and content of the information system or systems describing the economic entity and the social and economic environment in which it performs. The implication of REH is that the accounting information system must be that information system and must provide the needed description in an independent, verifiable, efficient, and economical manner.

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